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UTILITY PATENT APPLICATION TRANSMITTAL
(Small Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No. 0111084/037

Total Pages in this Submission 96

TO THE ASSISTANT COMMISSIONER FOR PATENTS
Box Patent Application
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

DETECTION LAMP EQUIPPED WITH LIGHT-EMITTING DIODE

and invented by:

Phil Trigiani

If a CONTINUATION APPLICATION, *check appropriate box and supply the requisite information:*

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Which is a:

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Which is a:

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Enclosed are:

Application Elements

1. ☒ Filing fee as calculated and transmitted as described below

2. ☒ Specification having 21 pages and including the following:

   a. ☒ Descriptive Title of the Invention
   b. ☐ Cross References to Related Applications *(if applicable)*
   c. ☐ Statement Regarding Federally-sponsored Research/Development *(if applicable)*
   d. ☐ Reference to Microfiche Appendix *(if applicable)*
   e. ☒ Background of the Invention
   f. ☒ Brief Summary of the Invention
   g. ☒ Brief Description of the Drawings *(if drawings filed)*
   h. ☒ Detailed Description
   i. ☒ Claim(s) as Classified Below
   j. ☒ Abstract of the Disclosure

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Application Elements (Continued)

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*

   a. ☒ Formal b. ☐ Informal Number of Sheets 5

4. ☒ Oath or Declaration

   a. ☒ Newly executed *(original or copy)* ☐ Unexecuted

   b. ☐ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*

   c. ☒ With Power of Attorney ☐ Without Power of Attorney

   d. ☐ *DELETION OF INVENTOR(S)*
   Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. 1.63(d)(2) and 1.33(b).

5. ☐ Incorporation By Reference *(usable if Box 4b is checked)*
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. ☐ Computer Program in Microfiche

7. ☐ Genetic Sequence Submission *(if applicable, all must be included)*

   a. ☐ Paper Copy

   b. ☐ Computer Readable Copy

   c. ☐ Statement Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

8. ☒ Assignment Papers *(cover sheet & documents)*

9. ☒ 37 CFR 3.73(b) Statement *(when there is an assignee)*

10. ☐ English Translation Document *(if applicable)*

11. ☒ Information Disclosure Statement/PTO-1449 ☒ Copies of IDS Citations

12. ☐ Preliminary Amendment

13. ☒ Acknowledgment postcard

14. ☒ Certificate of Mailing

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Accompanying Application Parts (Continued)

15. ☐ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*

16. ☒ Small Entity Statement(s) - Specify Number of Statements Submitted: 2

17. ☐ Additional Enclosures *(please identify below):*

Request That Application Not Be Published Pursuant To 35 U.S.C. 122(b)(2)

18. ☐ Pursuant to 35 U.S.C. 122(b)(2), Applicant hereby requests that this patent application not be published pursuant to 35 U.S.C. 122(b)(1). Applicant hereby certifies that the invention disclosed in this application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication of applications 18 months after filing of the application.

Warning

An applicant who makes a request not to publish, but who subsequently files in a foreign country or under a multilateral international agreement specified in 35 U.S.C. 122(b)(2)(B)(i), must notify the Director of such filing not later than 45 days after the date of the filing of such foreign or international application. A failure of the applicant to provide such notice within the prescribed period shall result in the application being regarded as abandoned, unless it is shown to the satisfaction of the Director that the delay in submitting the notice was unintentional.

UTILITY PATENT APPLICATION TRANSMITTAL
(Small Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

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Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra	Rate	Fee
Total Claims	14	- 20 =	0	x $9.00	$0.00
Indep. Claims	2	- 3 =	0	x $40.00	$0.00
Multiple Dependent Claims (check if applicable) ☐					$0.00
				BASIC FEE	$355.00
OTHER FEE *(specify purpose)* _____					$0.00
				TOTAL FILING FEE	$355.00

☐ A check in the amount of to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. **02-1818** as described below. A duplicate copy of this sheet is enclosed.

- ☒ Charge the amount of **$355.00** as filing fee.
- ☒ Credit any overpayment.
- ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

Dated: **November 27, 2000**

Signature

Dante J. Picciano
Reg. No. 33,543

cc:

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) AND 1.27 (b)) - INDEPENDENT INVENTOR	Docket No. 0111084/037

Serial No.	Filing Date	Patent No.	Issue Date
-	-	-	-

Applicant/ Patentee: **Phil Trigiani**

Invention: **DETECTION LAMP EQUIPPED WITH LIGHT-EMITTING DIODE**

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled above and described in:

- ☒ the specification to be filed herewith.
- ☐ the application identified above.
- ☐ the patent identified above.

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☐ No such person, concern or organization exists.
- ☒ Each such person, concern or organization is listed below.

*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities (37 CFR 1.27)

FULL NAME **UView Ultraviolet Systems, Inc.**
ADDRESS **1324 Blundell Road, Mississauga, Ontario, Canada L4Y 1M5**

☐ Individual ☒ Small Business Concern ☐ Nonprofit Organization

FULL NAME
ADDRESS

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME
ADDRESS

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME
ADDRESS

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF INVENTOR **Phil Trigiani**
SIGNATURE OF INVENTOR ________ DATE: Nov 23, 2000

NAME OF INVENTOR ________
SIGNATURE OF INVENTOR ________ DATE: ________

NAME OF INVENTOR ________
SIGNATURE OF INVENTOR ________ DATE: ________

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SIGNATURE OF INVENTOR ________ DATE: ________

NAME OF INVENTOR ________
SIGNATURE OF INVENTOR ________ DATE: ________

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) AND 1.27 (c)) - SMALL BUSINESS CONCERN	Docket No. 0111084/037

Serial No.	Filing Date	Patent No.	Issue Date
-	-	-	-

Applicant/ Patentee: **Phil Trigiani**

Invention: **DETECTION LAMP EQUIPPED WITH LIGHT-EMITTING DIODE**

I hereby declare that I am:

- ☐ the owner of the small business concern identified below:
- ☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN: **UView Ultraviolet Systems, Inc.**

ADDRESS OF CONCERN: **1324 Blundell Road, Mississauga, Ontario, Canada L4Y 1M5**

I hereby declare that the above-identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the above identified invention described in:

- ☒ the specification filed herewith with title as listed above.
- ☐ the application identified above.
- ☐ the patent identified above.

If the rights held by the above-identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed on the next page and no rights to the invention are held by any person, other than the inventor, who could not qualify as an independent inventor under 37 CFR 1.9(c) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☒ no such person, concern or organization exists.
- ☐ each such person, concern or organization is listed below.

FULL NAME _____
ADDRESS _____

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME _____
ADDRESS _____

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME _____
ADDRESS _____

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME _____
ADDRESS _____

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING: **Phil Trigiani**

TITLE OF PERSON SIGNING OTHER THAN OWNER: **Chief Executive Officer**

ADDRESS OF PERSON SIGNING: **UView Ultraviolet Systems, Inc.**
1324 Blundell Road
Mississauga, Ontario
Canada L4Y 1M5

SIGNATURE: _____ DATE: Nov 23, 2000

DETECTION LAMP EQUIPPED WITH LIGHT-EMITTING DIODE

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

The present application is for a lamp for detecting leaks in commercial and industrial air-conditioning and refrigeration systems and other liquid recirculating systems such as those employing engine oil, transmission fluid and hydraulic fluid. The lamp uses a light-emitting diode (LED) as a light source to detect fluorescent dyes that have been added to the air-conditioning or refrigeration system.

2. DESCRIPTION OF THE RELATED ART

Leak detection, materials detection and qualitative non-destructive testing are well suited to techniques employing fluorescence detection. These techniques rely upon the unique physical property of various materials to fluoresce when excited by certain wavelengths of visible or ultraviolet (UV) light.

It is a well-known phenomenon that electromagnetic energy within the near ultraviolet spectrum of

approximately 315 to 400 nanometer wavelengths produces fluorescence in certain materials, e.g., fluorescent dyes. These fluorescent materials absorb radiated energy at the near UV wavelengths and re-radiate or emit it at a longer wavelength in the visible spectrum. Thus, when fluorescent material absorbs electromagnetic energy in a specific excitation frequency band in a specific wavelength range, the material can emit electromagnetic energy in a characteristic fluorescent emission frequency band within the visible light spectrum. This phenomenon has enabled inspection and detection techniques in which fluorescent dyes, inks or pigments are illuminated by lamps selectively filtered to emit only ultraviolet (invisible to the human eye) and then re-radiate with a high luminescence in the visible spectrum. Some newer fluorescent dyes respond well to higher wavelengths of light in the visible violet and blue range in addition to the invisible UV range.

For example, the slow leakage of refrigerant from an air conditioning system is difficult to locate by any other means. The reason for the difficulty is because the refrigerant escapes as an invisible gas at such a low rate and rapid diffusion that the concentration of refrigerant in air near the leak site is difficult to differentiate

from that surrounding any other location along the system circulation lines. However, by adding into the circulating system a small amount of fluorescent dye that is soluble in the refrigerant, the dye is carried out of the system with the refrigerant and glows brightly at the leak site when the area is swept with a UV lamp.

A similar procedure can be used to locate leaks of other fluids, such as lubricants, oils, fuels, heat transfer fluids or hydraulic fluids. Other UV inspection techniques use fluorescent dyes or paint to detect fissures or stress cracks in structural members.

Conventional inspection lamps employ high intensity light sources (incandescent bulbs) operating at high temperatures to generate a sufficient photon flux for detection applications and utilize filters to absorb the undesirable wavelengths. These bulbs give off light owing to their temperature (incandescence). The power of the lamps is very high in wattage and therefore the lamp produces heat. A black light filter can be used but the filter is very restrictive and allows only UV wavelengths to be transmitted while all of the remaining wavelengths are absorbed. These filters typically have a transmission efficiency of 50-70% for the UV wavelengths (320-380 nm).

To compensate for the limited transmission efficiency, the power of the lamps is very high in wattage and therefore heat producing. These lamps are usually 20-150 watts. Consequently, the life expectancy of the bulb is limited.

The fluorescent dyes used in this system typically have maximum excitation in the range of 320-380 nm. Some newer dyes respond well to higher wavelengths of light in the visible violet and blue range in addition to the invisible UV range (340-440 nm). With these dyes, improved photographic-type blue filters are used with smaller, low wattage lamps. These blue filters work well in lamps of 50 watts or less. At 50 watts, the lamps do not produce as much heat and although the blue filter allows some visible light to be transmitted, the dyes are still acceptably excited. In most cases, the lamps using these blue filters are also sold with special glasses (blue blocker glasses) that block the visible blue spectrum light transmitted through the blue filters. These glasses assist the operator in finding the leaks and seeing the dye reaction to UV, blue and violet light. In addition, these blue filters are much more prone to temperature damage and cracking than the black light filters. However, the transmission efficiency is greater by about 10% as compared

to that for the black light filters. Also, the blue filters and the blue blocker glasses make the dye more visible to the technician.

Newer improved filters have been developed by applying a dielectric coating, that does not effect the visible and lower spectrum of light transmission, to a piece of glass. Such filters are referred to as dielectric or dichroic filters. These terms are interchangeable. Dielectric refers to the process used, and dichroic is the type of coating applied, also known as thin-film coating. For example, dichroic filters with a dielectric coating have been developed in the entertainment industry and have high levels of transmission. The dichroic filter with a dielectric coating allows UV, blue and IR wavelengths to be transmitted while most visible wavelengths are blocked. Thus, this type of filter does not absorb the IR heat and has a transmission efficiency of over 90% for the desired wavelengths. These advantages allow users to reduce the size and wattage of the detection lamps.

Luminescence, on the other hand, is the result of electronic excitation of a material. The light-emitting diode (LED) is a p-n junction in which an applied voltage yields a flow of current, and the recombination of the

carriers injected across the junction results in the emission of light. The process involved here is in effect electroluminescence. The ratio of the number of emitted photons to the number of electrons crossing the p-n junction is the quantum efficiency. LED emission is generally in the visible part of the spectrum with wavelengths from 400 nm to 700 nm or in the near infrared with wavelengths between 700 and 2000 nm.

Red, yellow and green light-emitting diodes are known. More than 20 billion LEDs are produced each year. Visible LEDs are used as numeric displays or indicator lamps and are sufficiently bright that a row of red LEDs are used in an automobile spoiler to replace the conventional rear-window brake light. Infrared LEDs are employed in optoisolators, in television remote controls, and as sources in optical communication systems. The applied voltage is near 2.0 volts. The current depends on the application and ranges from a few milliamperes to several hundred milliamperes. Thus, LEDs function with low power drain, at reduced temperatures and have an extremely long life expectancy, e.g., five to ten years or more, as compared to incandescent bulbs.

The present application reveals a lamp for detecting fluorescent dyes in an air-conditioning or refrigeration system. The lamp uses a light-emitting diode as a light source rather than conventional UV-emitting light sources. Consequently, the lamp operates with low power drain, at reduced temperatures and has an extremely long life expectancy as compared to conventional detection lamps equipped with incandescent bulbs.

SUMMARY OF THE INVENTION

The present application discloses a lamp and a method for detecting fluorescent dyes that have been added to an air conditioning or refrigeration system, where the fluorescent dyes reemit light at a wavelength greater than the wavelength of light emitted from the lamp. The lamp comprises a lamp housing, at least one light-emitting diode within the lamp housing and means for providing power to the lamp, where the light emitted from the lamp is restricted to a predetermined range effective to enhance the reemission of light from the fluorescent dyes.

In preferred embodiments of the lamp, the diode is a blue light-emitting diode or a UV light-emitting diode and the blue light-emitting diode is an indium gallium nitride

semiconductor. In other preferred embodiments, the blue light-emitting diode is a laser diode and the laser diode is a gallium nitride based laser diode.

In yet other preferred embodiments, the lamp further comprises a protector ring connected to the lamp housing and a lens positioned within the protector ring. The lens can be a filter selected from the group consisting of black, red, amber, yellow, green, blue, indigo, violet, UV light and full spectrum filters. In other preferred embodiments, the lens is a dichroic filter and the lamp further comprises a blocker glass.

In more preferred embodiments, the lamp further comprises a plurality of light-emitting diodes and each of the light-emitting diodes emits the same color light.

The present application also discloses a method for detecting leaks in an air-conditioning or refrigeration system. The method comprises the steps of inserting a fluorescent dye into an air-conditioning or refrigeration system, running or operating the air-conditioning or refrigeration system and inspecting the air-conditioning or refrigeration system with a lamp comprised of housing, at least one light-emitting diode within the lamp housing and means for providing power to the lamp.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic representation of a light-emitting diode.

Figure 2 shows an embodiment of the detection lamp of the present invention equipped with a single LED light source.

Figure 3 shows an embodiment of the detection lamp of the present invention equipped with a single LED light source and a lens.

Figure 4 shows an embodiment of the detection lamp of the present invention equipped with multiple LED light sources.

Figure 5 shows an embodiment of the detection lamp of the present invention equipped with multiple LED light sources and a lens.

DETAILED DESCRIPTION

The present invention is for a lamp and a method for detecting leaks in an air-conditioning or refrigeration system. The lamp uses a light-emitting diode (LED) as a light source for detecting a fluorescent dye that has been added to the air-conditioning or refrigeration system.

Figure 1 shows a light-emitting diode. Power is applied to one side of the LED semiconductor through a positive power lead or anode **1** and a whisker **4**. The other side of the semiconductor is attached to the top of an anvil **7** that is the negative power lead or cathode **2**. It is the chemical makeup of the LED semiconductor **6** that determines the color of the light the LED produces.

Semiconductors can be made of, for example, gallium arsenide, GaAs; gallium arsenide phosphide, $GaAs_{1-x}P_x$; aluminum gallium arsenide, $Al_xGa_{1-x}As$; aluminum gallium indium phosphide, $(Al_xGa_{1-x})_yIn_{1-y}P$; gallium indium arsenide phosphide, $Ga_xIn_{1-x}As_yP_{1-y}$, etc. LEDs can be used to produce infrared, red, amber, yellow, green, blue, indigo, violet, ultraviolet or even white light. White light is a combination of red, green and blue light. Presently, it is possible to produce white light with a single LED using a phosphor layer (yttrium aluminum garnet) on the surface of a blue (gallium nitride) chip. The blue light-emitting diode is preferred and uses an indium gallium nitride (InGaN) semiconductor **6**.

A high impact plastic or epoxy resin enclosure **3** surrounds the semiconductor **6** and has two main functions. It is designed to allow the most light to escape from the

semiconductor and it protects the LED semiconductor from the surrounding environment. A lens **5** focuses the light (view angle) escaping from the semiconductor. The entire unit is totally embedded in epoxy. This makes the LED virtually indestructible. There are no loose or moving parts within the solid epoxy enclosure. Therefore, the light-emitting diode is essentially a p-n junction semiconductor diode that emits light when current is applied. By definition, it is a solid-state device that controls current without heated filaments and is thus very reliable.

The light-emitting diodes of the present invention include laser diodes. These laser diodes produce a narrower spectrum of light than conventional LEDs. For example, Toshiba (Japan) has developed a gallium nitride (GaN) based blue diode that emits light at a wavelength of 417 nm. This laser diode is comprised of ultra-thin layers of indium gallium nitride (InGaN). Nichia Chemical Industrial Co, Ltd. (Japan) has developed a laser diode that emits light in the violet spectrum. This laser diode uses a sapphire substrate. First, a 100 micron-thick gallium nitride (GaN) layer is formed on the sapphire

substrate and then the sapphire substrate is removed by polishing to leave an 80 micron-thick GaN substrate.

Figure 2 shows an embodiment of the detection lamp of the present invention equipped with a single LED. The detection lamp is comprised of a lamp housing **10**, a protector ring or cap **20**, a single light-emitting diode **30** within the lamp housing and a cable **40** for connection to a power source. Obviously, the housing can have any shape provided that the light from the LED is emitted from the housing.

The detection lamp can function without the use of filters, thereby lowering the manufacturing cost. Since the size of the LED is considerably smaller than that of conventional incandescent bulbs, the detection lamp can be miniaturized, thereby facilitating maneuvering inside an engine compartment and around an air-conditioning system of an automobile. The inspection lamp equipped with an LED is extremely durable, drop resistant and impact resistant, in part, because of the construction of the LED, as described above. Also, the inspection lamp can be made waterproof which is a great advantage in an automotive service environment exposed to numerous liquids and solvents.

Furthermore, the inspection lamp uses a very low current. For example, it can be operated with 2-5 volts. The lamp can be powered by AC, DC or even solar power. Also, there is a constant output of light regardless of voltage. There is very little heat produced and this is extremely advantageous for a mechanic working around the exposed engine compartment of an automobile.

Figure 3 shows an embodiment of the detection lamp of the present invention equipped with a single LED and a lens. The detection lamp is comprised of a lamp housing **10**, a protector ring or cap **20**, which also functions as a lens holder, a lens or filter **50**, a single light-emitting diode **30** within the lamp housing and a cable **40** for connection to a power source.

The lens functions to block out undesirable wavelengths emitted from the LED and to transmit only the desired wavelengths. For example, a blue LED emitting at 430-470 nm can be equipped with a filter blocking or reflecting wavelengths between 450-500 nm. Therefore, only wavelengths between 430-450 nm will be transmitted from the lens. The lens may be selected from black light, blue light or any desired wavelength blocker or transmitter, even a full spectrum filter. Thus, dichroic filters may be

used in the present invention. Furthermore, a blocker glass can be used in conjunction with the lens, e.g., a blue blocker glass can be used with a blue filter or lens. The choice of the filter will depend on the color emitted by the LED and the wavelength desired to be transmitted from the lamp.

The inspection lamp can be equipped with more than one LED, for example, 2, 5, 10, 25 or more, to increase the light output of the lamp. Typically, the life expectancy of the blue LED exceeds 100,000 hours.

Figure 4 shows an embodiment of the detection lamp of the present invention equipped with multiple LEDs. The detection lamp is comprised of a lamp housing **10**, a protector ring or cap **20**, multiple light-emitting diodes **30** within the lamp housing and a cable **40** for connection to a power source.

In a preferred embodiment, each of the multiple light-emitting diodes emits the same color light. However, different color-emitting LEDs may be used in the same lamp. Thus, a red LED, a green LED and a blue LED can be used to generate white light in the lamp.

Figure 5 shows an embodiment of the detection lamp of the present invention equipped with multiple LEDs and a

lens. The detection lamp is comprised of a lamp housing **10**, a protector ring or cap **20**, which also functions as a lens holder, a lens or filter **50**, multiple light-emitting diodes **30** within the lamp housing and a cable **40** for connection to a power source.

The following non-limiting examples are included to demonstrate preferred embodiments of the invention. It should be appreciated by those skilled in the art that the techniques disclosed in the examples which follow represent techniques discovered by the inventor to function well in the practice of the invention, and thus can be considered to constitute preferred modes for its practice. However, those of skill in the art should, in light of the present disclosure, appreciate that many changes can be made in the specific embodiments which are disclosed and still obtain a like or similar result without departing from the concept, spirit and scope of the invention. More specifically, it will be apparent that certain components may be substituted for the components described herein while the same or similar results would be achieved. All such similar substitutes and modifications apparent to those skilled in the art are deemed to be within the spirit, scope and concept of the invention as defined by the appended claims.

EXAMPLES

EXAMPLE 1

7.5 ml of fluorescent dye (part no. 399006, UView Ultraviolet Systems, Inc., Mississauga, Ontario, Canada) were inserted into an automotive air-conditioning system of a 1999 Mercedes ML430. The dye fluoresces in the excitation range of 450-550 nm. The air-conditioning system was turned on and allowed to run for one minute. The air-conditioning system was inspected for leaks using an ultraviolet lamp equipped with a blue light-emitting diode. The lamp is shown in Figure 2. The blue LED was purchased from Hosfelt Electronics (part no. 25-368, Steubenville, Ohio) and emitted blue light in the range of 450-600 nm. Within one minute of inspection, a leak was detected directly below the compressor and appropriate repairs made.

EXAMPLE 2

7.5 ml of the same fluorescent dye used in Example 1 were inserted into an automotive air-conditioning system of a 2001 Chrysler PT Cruiser. The air-conditioning system was turned on and allowed to run for two minutes. The air-

conditioning system was inspected for leaks using an ultraviolet lamp equipped with five blue light-emitting diodes. The lamp is shown in Figure 4. The blue LEDs were purchased from Hosfelt Electronics (part no. 25-368, Steubenville, Ohio) and emitted blue light in the range of 450-600 nm. Within one minute of inspection, a leak was detected in a connection to the condenser and appropriate repairs made.

While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but on the contrary is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

Thus, it is to be understood that variations in the present invention can be made without departing from the novel aspects of this invention as defined in the claims. All patents and articles cited herein are hereby incorporated by reference in their entirety and relied upon.

CLAIMS

WHAT IS CLAIMED IS:

1. A lamp for detecting fluorescent dyes light that have been added to an air conditioning or refrigeration system, wherein the fluorescent dyes reemit light at a wavelength greater than the wavelength of light emitted from the lamp, the lamp comprising:

a) a lamp housing;

b) at least one light-emitting diode within the lamp housing; and

c) means for providing power to the lamp,

wherein the light emitted from the lamp is restricted to a predetermined range effective to enhance the reemission of light from the fluorescent dyes.

2. The lamp of claim 1, wherein the diode is a blue light-emitting diode.

3. The lamp of claim 1, wherein the diode is a UV light-emitting diode.

4. The lamp of claim 2, wherein the blue light-emitting diode is an indium gallium nitride semiconductor.

5. The lamp of claim 2, wherein the blue light-emitting diode is a laser diode.

6. The lamp of claim 5, wherein the laser diode is a gallium nitride based laser diode.

7. The lamp of claim 1, further comprising a protector ring connected to the lamp housing.

8. The lamp of claim 7, further comprising a lens positioned within the protector ring.

9. The lamp of claim 8, wherein the lens is a filter selected from the group consisting of black, red, amber, yellow, green, blue, indigo, violet, UV light and full spectrum filters.

10. The lamp of claim 9, further comprising a blocker glass.

11. The lamp of claim 9, wherein the lens is a dichroic filter.

12. The lamp of claim 1, further comprising a plurality of light-emitting diodes.

13. The lamp of claim 12, wherein each of the light-emitting diodes emits the same color light.

14. A method for detecting leaks in an air-conditioning or refrigeration system, comprising the steps of:

a) inserting a fluorescent dye into an air-conditioning or refrigeration system;

b) running the air-conditioning or refrigeration system; and

c) inspecting the air-conditioning or refrigeration system with the lamp of claim 1.

U.S. PATENT APPLICATION OF PHIL TRIGIANI

ABSTRACT

The present application reveals a lamp and a method for detecting leaks in air-conditioning and refrigeration systems. The lamp uses one or more light-emitting diodes (LEDs) as a light source to detect fluorescent dyes that have been added to the air-conditioning or refrigeration system.

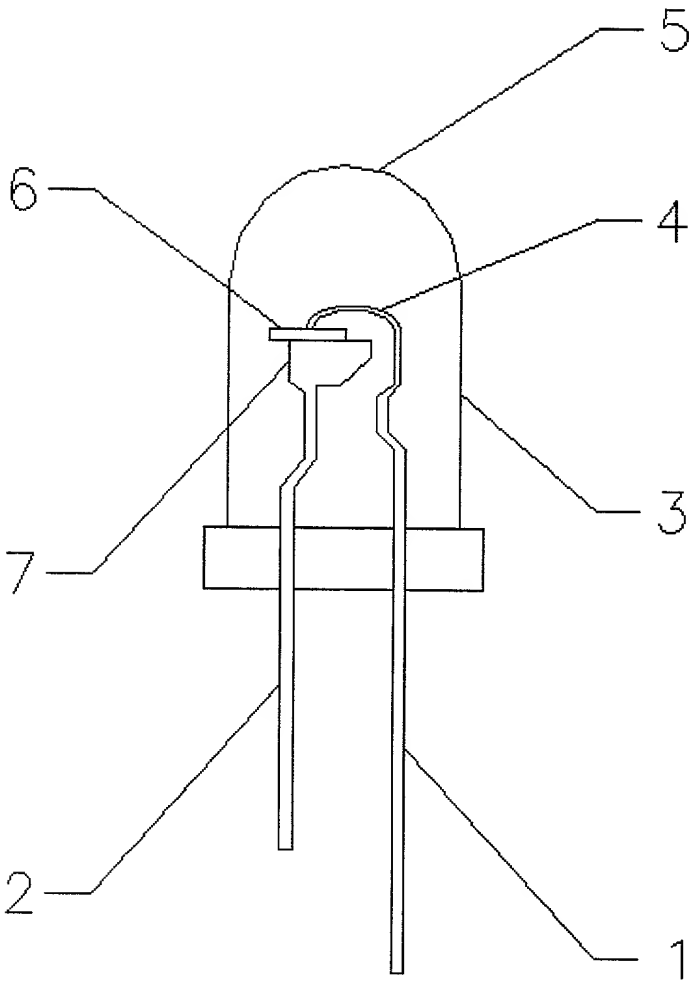

FIGURE 1: DETAILED LED

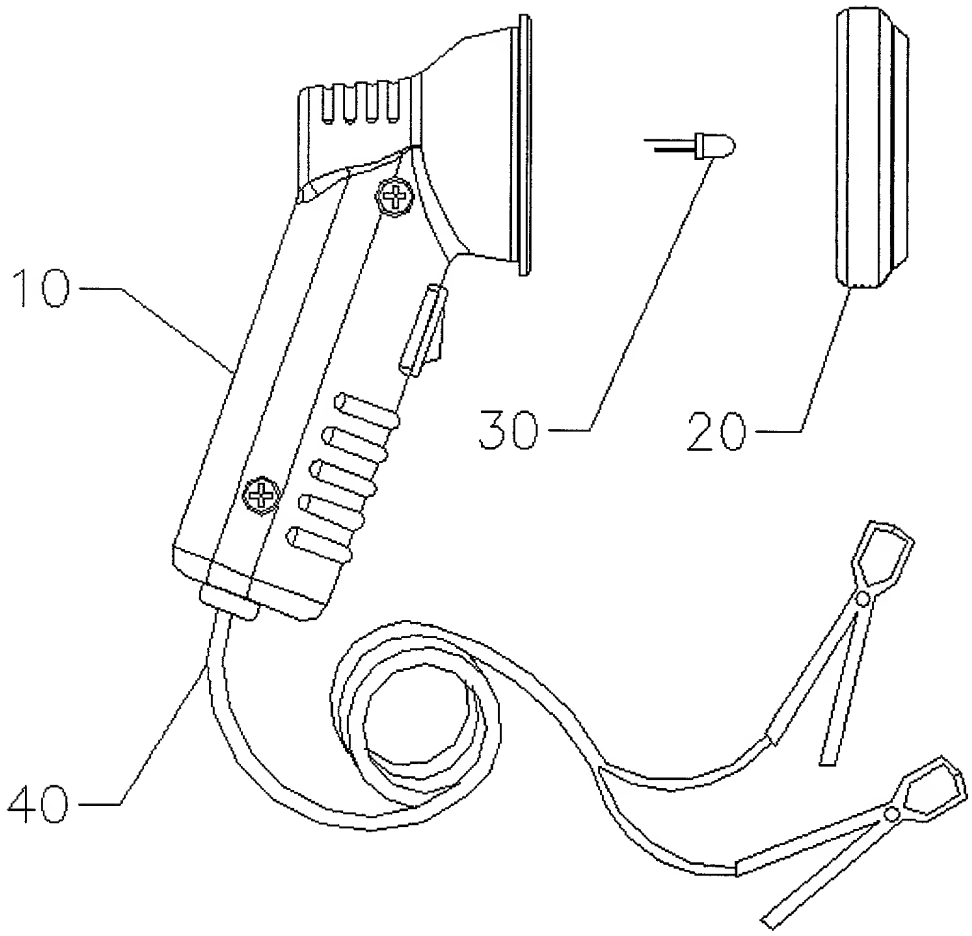

FIGURE 2: SINGLE LED LIGHT

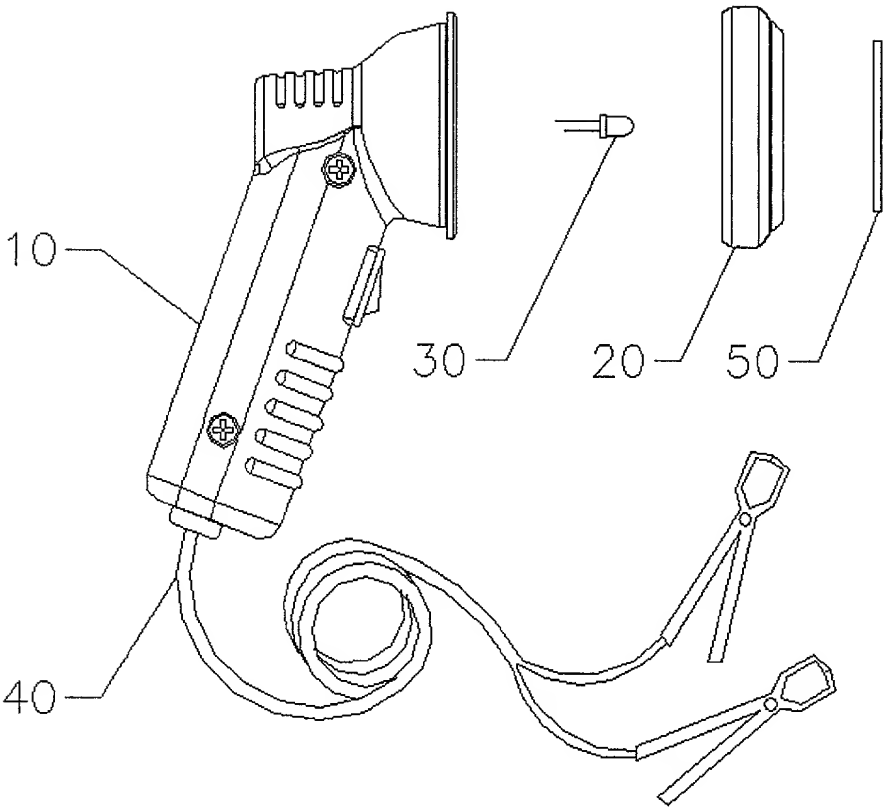

FIGURE 3: SINGLE LED LIGHT WITH LENS

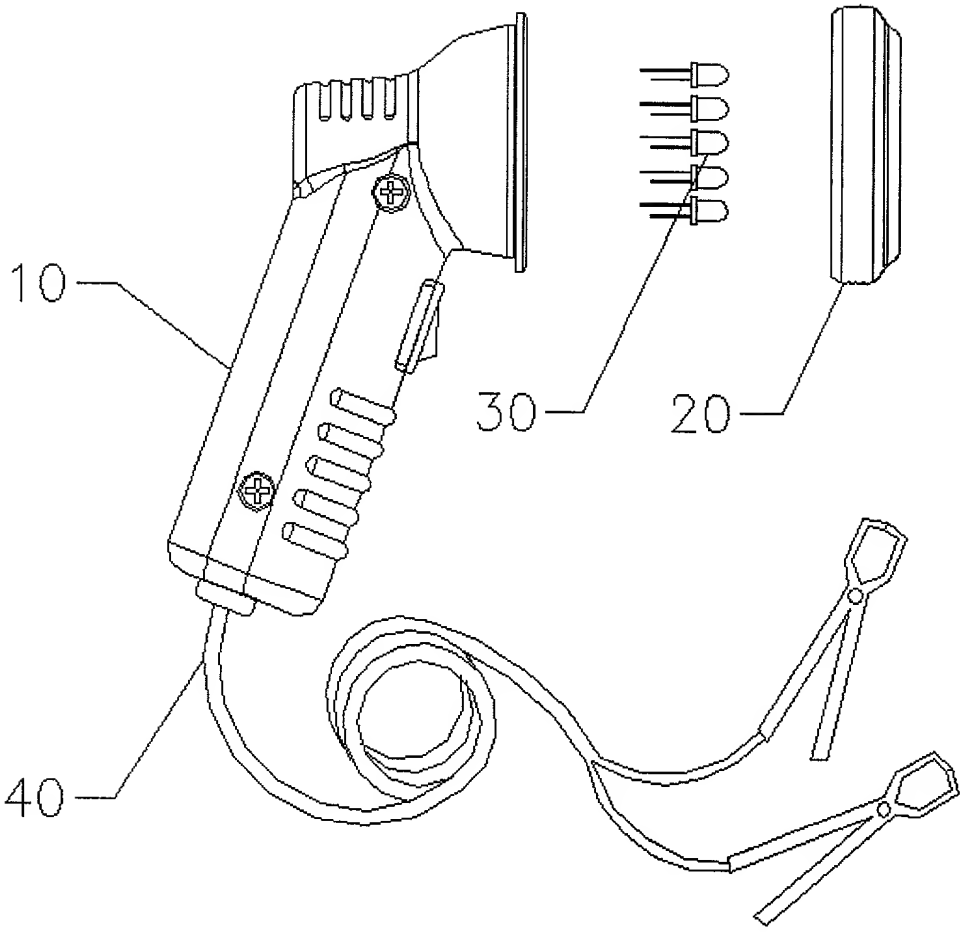

FIGURE 4: MULTIPLE LED LIGHT

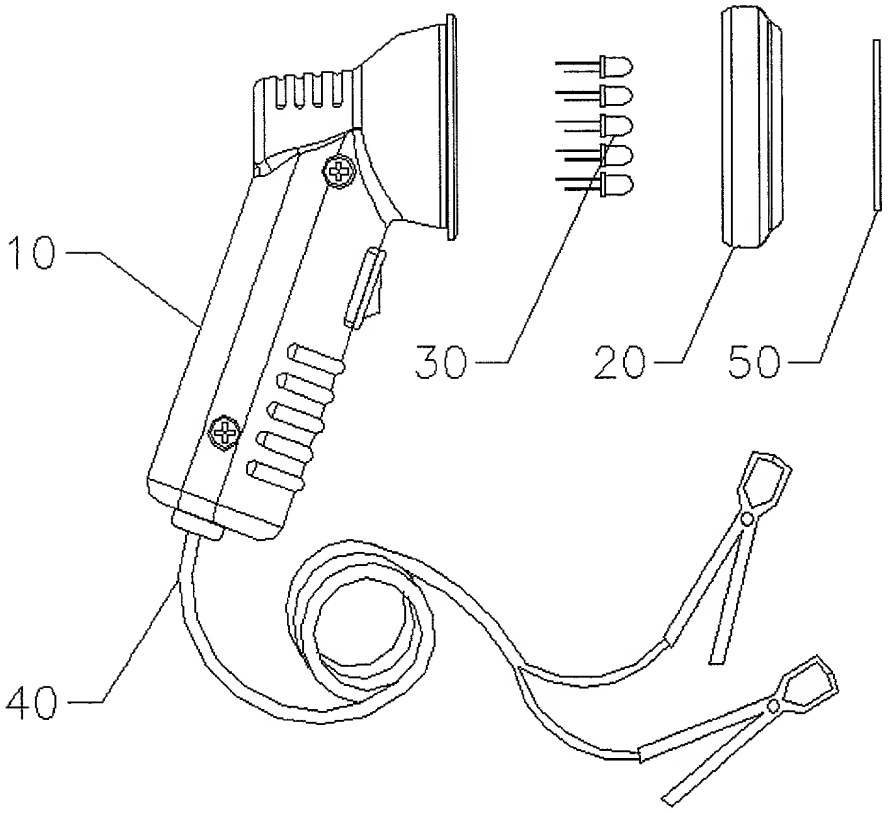

FIGURE 5: MULTIPLE LED LIGHT WITH LENS

Docket No.
0111084/037

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

DETECTION LAMP EQUIPPED WITH LIGHT-EMITTING DIODE

the specification of which

(check one)

- ☒ is attached hereto.
- ☐ was filed on _____ as United States Application No. or PCT International Application Number _____
  and was amended on _____
  (if applicable)

☐ I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

☐ I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority Not Claimed
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	☐
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	☐
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	☐

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

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Second inventor's signature Date
Residence
Citizenship
Post Office Address

PTO/SB/96 (2-98)
Approved for use through 09/30/2000. OMB 0651-0031
Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

STATEMENT UNDER 37 CFR 3.73(b)

Applicant: **Phil Trigiani**

Application No.: _____ Filed: _____

Entitled: **DETECTION LAMP EQUIPPED WITH LIGHT-EMITTING DIODE**

UView Ultraviolet Systems, Inc., a **corporation**,

(Name of Assignee) (Type of Assignee, e g , corporation, partnership, university, government agency, etc)

states that it is:

1. [✓] the assignee of the entire right, title, and interest; or

2. [ ] an assignee of an undivided part interest

in the patent application identified above by virtue of either:

A. [ ] An assignment from the inventor(s) of the patent application identified above. The assignment was recorded in the Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

OR

B. [ ] A chain of title from the inventor(s), of the patent application identified above, to the current assignee as shown below.

1. From: _____ To: _____
   The document was recorded in the Patent and Trademark Office at
   Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____
   The document was recorded in the Patent and Trademark Office at
   Reel _____, Frame _____, or for which a copy thereof is attached.

3. From: _____ To: _____
   The document was recorded in the Patent and Trademark Office at
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[ ] Additional documents in the chain of title are listed on a supplemental sheet.

[✓] Copies of assignments or other documents in the chain of title are attached.

The undersigned (whose title is supplied below) is empowered to sign this statement on behalf of the assignee.

Nov 23, 2000
Date

Signature

Phil Trigiani
Typed or printed name

CEO, UView Ultraviolet Systems, Inc.
Title